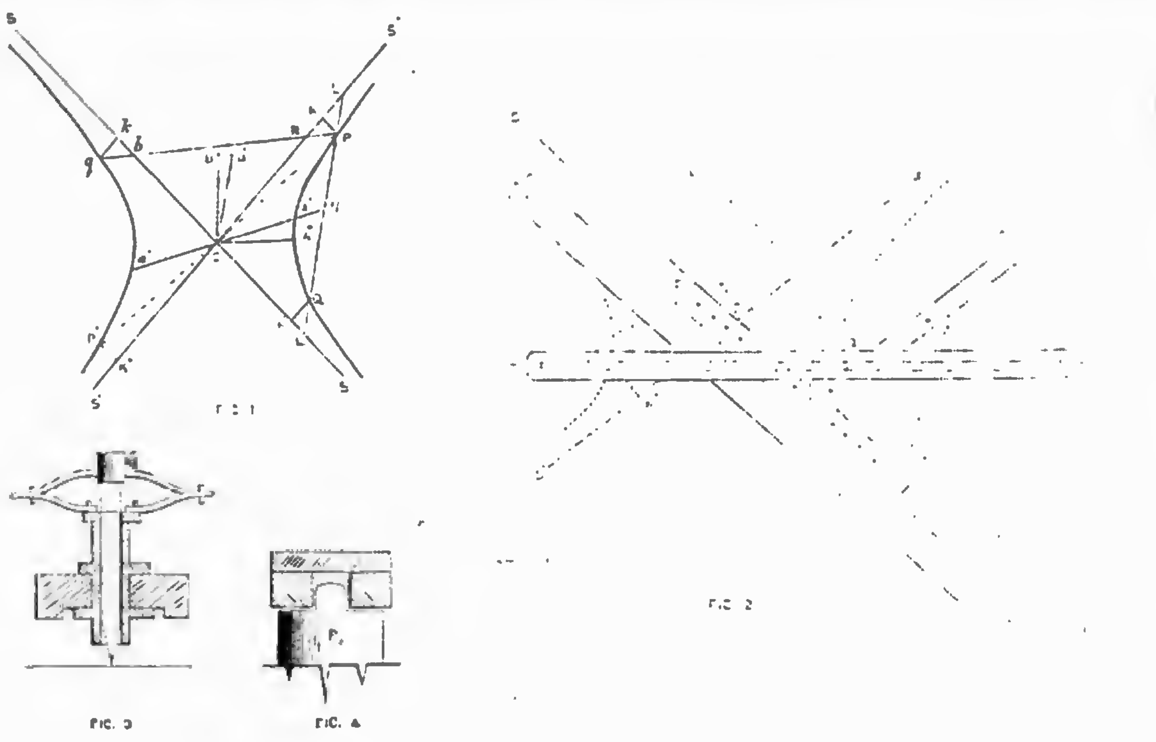
INSTRUMENT FOR DRAWING THE HYPERBOLA.



of the north, east, and west wings, are each 65 feet high and 13 feet in diameter.

The proportions of the building are arithmetical:—the centre building is a cube of 75 feet, with the corners subtended; the superintendent's house is a cube of 50 feet; the north wing is two cubes of 50 feet each; the south wing is two cubes of 50 feet each; and the east wing four cubes of 50 feet each.

The paupers, as they arrive, are received at a central point, under the eye of the superintendent, in his office, as they approach; thoroughly cleaned, if necessary, in the basement central apartments for cleansing; and distributed, when prepared for distribution, to those parts of the building assigned to the classes to which they belong.

There is a chapel, with a gallery, occupying 75 by 75 feet, on the third floor of the centre building, two stories in height—the floors of the chapel and gallery being on a level with the third story and the attic floors,—which is well lighted, in a central position, of convenient access from all parts of the establishment, and which is commodious enough for those who are able to attend religious worship out of even a larger population than 1200.

Large folding-doors, or traversing-doors, are an original feature of this plan, and answer, by being opened wide, and by turning, in different directions, important ends, in making rooms for particular purposes, when they are wanted; and when such rooms are not wanted, in being opened wide, or turned back, so as to leave the supervision unobstructed, and change the circulation of the air throughout the establishment.

It is not absolutely a fire-proof building, but the roof is slated; the floors are double, and laid with mortar between them; the ceilings under the floors, and over the rooms, consist of joists, and the bottom of the lower side of the double floors; the walls are brick, built hollow, and without lath and plaster on the inside, or coverings of any kind on the outside; the windows are wooden sashes, but they are set in a thick double brick wall, and may each and every one of them burn without burning another. All the wings are separated from the centre building by a thick brick wall, covered and secured in all its openings, with iron doors and shutters, and rising above the roof of the wing, so as to make a barricade against fire, behind which the inmates of a wing on fire may retreat, and firemen may be protected.

The building is all under contract, and the whole was to be finished on the first day of July, 1850, at an expense not exceeding 150,000 dollars.

Annexed we give plan of the ground floor. A view of the building will be found at page 294.

DESCRIPTION OF AN INSTRUMENT FOR DRAWING THE HYPERBOLA BY CONTINUED MOTION.

The diagram fig. 1 is intended to explain the property of the hyperbola, upon which the method is based. Let the curve PA'Q, Pa'q be a hyperbola, of which C is the centre, and Ss S's' the asymptotes, P any point in the curve.

Through P draw any straight lines LL' Pq, &c., so as to cut both the curve and the asymptotes in QL', ql, &c. Through Q and q draw QK' qk parallel to S's', and through P, PK parallel to the other asymptote Ss. Then shall the bases KL kl of the triangles QKL qkl, &c. be constant, and always equal PK.*

The instrument is composed of five principal parts:—

I. A fixed point P, see fig. 4, which may be fastened to the drawing board by pins or weights, or any other method.

II. A straight edge DD', which I call the *asymptote bar*.

III. A *radial bar* TT', with a socket at L, on one side of which it is grooved as TL (compare fig. 4), and slit on the other as LT', (comp. fig. 3).

IV. A bevel composed of two parts, the *base bar* FF', and the *parallel bar* K'G. The former must have a point centrically placed on its upper line, and fitted to the socket L on the *radial bar*; it should also be graduated on each side of that point, towards m and C. It must be so contrived by grooves and clamps, that the *parallel bar* may be placed at any distance from L along the *base bar*, and may make any angle with it.

V. The pencil tube, fig. 3, must slide between the two rails, if they may be so termed, of the slit portion of the *radial bar*, by means of the double flange on its lower part. The thickness of the flange must be let into the above-mentioned rails, but the tube itself fall a little below them. There should also be provided a spring of steel, or elastic band, to keep the pencil down upon the paper.

Let it be proposed to draw the curve PA'Q of the diagram figure 1, the asymptotes SsS's and the point P being given. The position of the fixed point P' is first found from P by cutting off P'C=PC from the straight line PC produced.

The *asymptote bar* DD' is then fixed parallel to Ss, and just the thickness of the *base bar* FF' below it.

The bevel FK'G is so adjusted that LK'= P'K' or PK (allowance must be made for the semidiameter of the pencil tube), and the parallel bar K'G must be set parallel S's' and clamped, and further secured by a strut Mm provided for that purpose. Lastly, the socket and point at L must be fitted to one another, and the groove TL placed upon the fixed point P', the pencil tube brought up to press upon the *parallel bar* as at Q, and the pencil itself upon the paper by means of the spring.

All that now remains to be done is to slide the base bar upon the asymptote bar, and keep the bottom of the pencil tube in contact with the parallel bar, which is generally done by the help of a piece of string. The curve may thus be drawn with great accuracy.

I have met with four other methods of drawing the hyperbola by continued motion: one is given by Mr. Olinthus Gregory, in his "Mathematics for Practical Men;" another by Mr. Hymers, in his "Treatise on Conic Sections." The two others are the inventions of Mr. Child and Mr. Godfray, and have appeared in the "Mechanics' Magazine." Of these the first is certainly the best; it does not, however, seem calculated to give so great a degree of accuracy at a distance from the vertex as the method here represented. The instrument described in this letter has also the advantage of supplying the means of drawing the conchoid of Nicomedes; for it will be obvious from the nature of the motion of the point L in the radial bar, along the straight line

* This is readily proved from the relations of the asymptote and the curve, with respect to conjugate diameters. Draw the axes CB' CA" respectively parallel to LL' and Pq, and let CA' CB" be their conjugates; produce CA' to N. It is a well known property of the conic sections, that each of the straight lines, forming a pair of conjugate axes will, if produced, bisect all chords drawn to meet the curve parallel to the other line. Hence because CA' is conjugate to CB', and QP is parallel to the latter, ∴ NP = NQ. This property is independent of the size of the axis, and is, therefore, true of the asymptote itself, which may be considered a similar hyperbola to PAQ', whose axis is zero. Hence also NL = NL' (the same thing may also be proved directly for the asymptote, as it forms the diagonal of the parallelogram, constructed about the centre, upon the conjugate axes.) But NL — NP = NL' — NQ, that is, PL = QL; but the triangles have the angles about their equal sides equal, therefore the bases are equal, i.e. K'L' = PK. An exactly similar proof shows PK = ql, and therefore kl = PK.